Congressional Notification Profile

DE-PS26-02NT41369

UNIVERSITY COAL RESEARCH PROGRAM, CORE PROGRAM
University of Florida

Background and Technical Information:
Project Title: "Multifunctional Solid-State Sensor for Coal Combustion Control."

The University of Florida proposes to use a unique approach which will allow the use of a rugged oxygen sensor it has developed as an inexpensive way to measure concentrations of multiple pollutants in coal-combustion exhaust. The approach, "Differential Electrode Equilibria", provides the necessary sensor selectivity to measure NOx, CO and O2. The goal is to develop a miniature low-cost multifunctional sensor prototype for evaluation by commercial/industrial companies.

Solid-state sensors stand up well in harsh environments. If the university successfully advances a prototype, it will, in turn, advance the science of solid-state electrochemical sensors and move closer toward commercializing a device that improves fuel use and reduces coal plant emissions.

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Congressional District: 05 District County: Alachua

Financial Information:

Length of Contract (months): 12
Government Share: $200,000
Total value of contract: $250,962

DOE Funding Breakdown:
Funds: Phase and/or FY 2002 $200,000

Multifunctional (NO_x/CO/O_2) Solid-State Sensor FOR COAL COMBUSTION CONTROL

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We have developed solid-state sensor technology that can provide an inexpensive, rugged, solid-state device capable of measuring the concentration of multiple species (such as NO and CO) in coal combustion exhaust. These small (<1 cm_2) simple potentiometric (voltage output) sensors are sensitive to each of these gasses and can be readily combined on a single chip to provide a multifunctional (NO_x, CO, O_2) sensor. This technology is the basis for a low cost, simplified way to meet emissions monitoring regulations. In addition, this type of sensor can be used to improve combustion control, resulting in both improved fuel utilization and reduced emissions.

Multifunctional NO, CO, O_2 sensor.

Our sensor technology is similar to that used in conventional automotive O_2 sensors and thus can be used directly in high temperature exhaust. However, both the sensing and reference electrode are in the same gas stream, significantly reducing fabrication costs. The major technical challenge to developing and commercializing low-cost, solid-state, electrochemical sensors for emissions monitoring is attaining the necessary gas selectivity. Specifically, the sensors must exhibit a highly selective response to ppm levels of NO_x and CO in the presence of percent levels of O_2.

We have developed an approach "Differential Electrode Equilibria" that provides the necessary sensor selectivity. We have demonstrated that this approach provides the selectivity to measure, for example, ppm levels of NO with high sensitivity in lean-burn (13-17% O_2) exhaust gas. Moreover, due to the selectivity of our sensor the O_2 concentration can vary over a wide range with negligible effect on our sensors response to NO concentration. In addition, our sensor provides rapid (~1 s) reversible response to fluctuations in gas concentration.

Since we have already demonstrated this approach works for NO the goals of our proposed research are to: advance the fundamental understanding of this approach by applying it to the development of selective NO_2, CO and O_2 electrode elements; fabricate and test a multifunctional (NO_x, CO, O_2) sensor; and develop a miniature low-cost multifunctional (NO_x, CO, O_2) sensor prototype for evaluation by commercial/industrial companies. In achieving these goals we will both advance the science of solid-state electrochemical sensors as well as bring closer to commercialization a device that will result in both improved fuel utilization and reduced emissions from coal combustion.